NU Rounds

Vol 4 | Issue 40 | 2023

Dear Doctor,

Greetings from Micro Labs limited. We are happy to bring you "NU Rounds" which contains latest and interesting news in the field of Nephrology and Urology.

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Looking forward to your valuable feedback

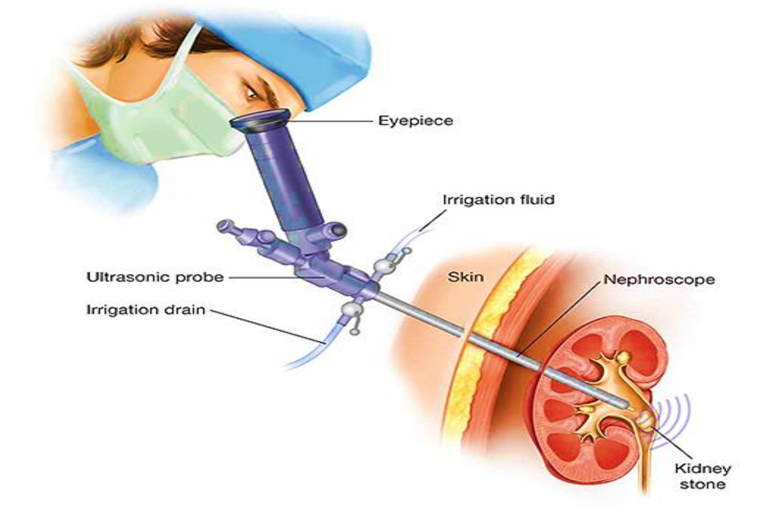
Best Regards,

Medical Team, Micro Labs Ltd

1. Evaluation of Machine learning model (MLM) for predicting the stone-free status (SFS) of percutaneous nephrolithotomy (PCNL)

Introduction:

Urolithiasis (or nephrolithiasis) is a prevalent condition that affects 1–13% of the world's population. It has increased in incidence over the past 40 years and is more common among obese Caucasian men. It also has high morbidity. Extracorporeal shockwave lithotripsy (ESWL), ureteroscopic lithotripsy (URSL), and percutaneous nephrolithotomy (PCNL) are some of the current methods used to treat kidney stones. A few pre-operative nomograms are in place to help forecast success rates, especially stone-free status (SFS) and potential complications; nomograms also serve to systematise the reporting and interpretation of the surgery's results. The S.T.O.N.E. score, S-ReSC score, Guy's Stone Score (GSS), and CROES nephrolithometry score are a few examples of these nomograms.[1] Clinical medicine has made substantial use of machine learning techniques, particularly for creating prediction models. The machine learning-based programme outperformed the GSS and CROES nomograms in predicting SFS following PCNL, with an AUC of 0.915 versus 0.615 and 0.621, respectively.[2] The purpose of the study was to develop a machine learning model (MLM) to predict whether patients having percutaneous nephrolithotomy (PCNL) will be stone-free and to assess how well it performs in comparison to S.T.O.N.E. and Guy's stone scores.



Percutaneous nephrolithotomy

Methods: A total of 320 PCNL patients were included in this retrospective analysis. Imaging techniques like X-rays or CT scans, as well as direct examination of the kidney with the nephroscope, were used to establish whether stone-free status had been reached. Age, gender, high blood pressure, diabetes, high cholesterol, preoperative haemoglobin, renal insufficiency, recent UTIs (Urinary tract infections), prior surgeries on the target kidney, stone burden, stone placement, and hydronephrosis were the preoperative factors. Fever, septicemia, the requirement for a blood transfusion, the length of hospitalisation, further operations, and the presence of stones were postoperative factors. The patients were categorised pre- and postoperatively using three MLMs: Random Forest Classifier (RFC), Support Vector Classifier (SVC), and Extreme Gradient Boosting (XGBoost). Mean bootstrap estimation, 10-fold cross-validation, classification report, and Area Under the Curve (AUC) were utilised to evaluate each model's performance.

Results: The SFS was determined to be 69.4% among the 320 individuals who underwent PCNL. AUC was 0.761, accuracy was 0.74, 10-fold cross-validation was 0.744, and the RFC mean bootstrap estimate was 0.75 with a 95% confidence interval of [0.65-0.85]. The XGBoost AUC was 0.769, and the accuracy was 0.72. The SVM outcomes were 0.751 (AUC) and 0.74 (accuracy). The S.T.O.N.E. score was 0.71, while the AUC of Guy's Stone score was 0.666. The RFC external validation set had an accuracy of 0.70, a mean bootstrap estimate of 0.87, a 95% confidence interval, [0.81–0.92] and an AUC of 0.795, while the XGBoost outcomes were 0.74, 0.84 [0.78–0.91], and 0.84, respectively. The SVM outcomes were, correspondingly, 0.79, 0.86 [0.80-0.91], and 0.858 (Figure 1).

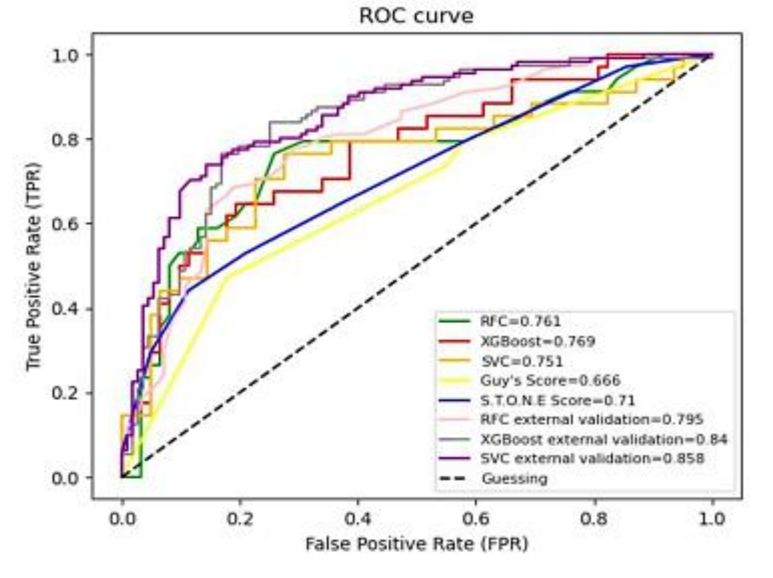


Figure 1 shows the ROC curves for the three MLMs, including the externally validated set, the GSS, and the S.T.O.N.E. score system.

Discussion: In this investigation, the SFS was determined to be 69.4%, and the AUC for RFC and SVM were 0.761 and 0.751, respectively. MLMs can be used to predict SFS for patients undergoing PCNL with a high degree of accuracy.[1] Similarly, in Zhao H. et al.'s investigation, the overall stone-free rate was 50%, and the AUCs of RFC and SVM were 0.803 and 0.818, respectively. These numbers exceeded Guy's score system's AUC, which was 0.800. Machine learning techniques have AUCs that are comparable to Guy's stone score and the S.T.O.N.E. score system for predicting the stone-free rate.[2] According to a study by Alghafees MA, et al., 86% of patients had stone-free status (SFS), and the Random Forest model had the highest accuracy in predicting SFS.[3]

Conclusion: The current study concludes that machine learning models can accurately predict stone-free status for patients undergoing percutaneous nephrolithotomy.

All machine learning techniques discovered that the patient's age, length of stay, and starting stone burden were the variables that had the biggest influence on stone-free status.

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2. Zhao H, et al. Predicting the Stone-Free Status of Percutaneous Nephrolithotomy with the Machine Learning System: Comparative Analysis with Guy's Stone Score and the STONE Score System. Frontiers in Molecular Biosciences. 2022; 9:880291.

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2. Evaluation of the feasibility of Prostate Cancer Radiological Estimation of Change in Sequential Evaluation (PRECISE) scoring and its diagnostic accuracy

Introduction: According to current recommendations, active surveillance (AS) is a suggested management method for low-risk and favourable intermediate-risk prostate cancer (PCa). This therapy technique reduces overtreatment and treatment-related side effects while demonstrating long-term oncological safety. The use of magnetic resonance imaging (MRI) for the assessment of PCa is growing along with the standard clinical (digital rectal examination), biochemical (prostate-specific antigen [PSA]), and pathological (prostate biopsy) measures.[1] The prostate cancer diagnostic route is made more accurate by using MRI-targeted biopsies and multiparametric magnetic resonance imaging (mpMRI). MRI-targeted biopsies, on the other hand, have been demonstrated to enhance risk stratification for patients choosing active surveillance (AS).[2] The Prostate Cancer Radiological Estimation of Change in Sequential Evaluation (PRECISE) recommendations suggested a consistent method for prostate MRI reporting for AS. MRI and AS experts across the world came to a consensus on these, which served as the foundation for these recommendations. A 1–5 Likert scale (PRECISE score) is used to calculate the likelihood of significant radiological progression. A PRECISE score of 1-2 indicates radiological regression, a PRECISE score of 3 indicates stability, and a PRECISE score of 4-5 implies progression.[1] So, this study assess the PRECISE score's diagnostic efficacy and its applicability.

Methods: In this retrospective study, 188 PCa patients with AS had a baseline MRI, and at least one follow-up MRI scan was included. PSA 20, clinical stage cT3, and biopsy-confirmed PCa with grading group (GG) 1 or GG 2 without invasive cribriform and intraductal carcinoma were the requirements for AS inclusion. Histopathological upgrading to grade group ≥ 3 (after biopsy or radical prostatectomy) and/or evolution to the T3 stage were used to indicate clinically significant progression. The PRECISE score was taken into account in a survival study to determine the differential progression-free survival (PFS).

Results: A total of 358 repeat MRI images and 144 repeat biopsies were taken among the study population. The median duration of follow-up was 46 months (interquartile range: 21–74 months). For clinically significant progression, radiological progression (PRECISE 4-5) demonstrated sensitivity (78%), specificity (70%), negative predictive value (90%), and positive predictive value (49%). Precise 1-3 had a four-year PFS of 91%, while Precise 4-5 had a PFS of 66% ($p < 0.001$). Within 18 months of their diagnosis, 137 individuals got a confirmation MRI scan. In this group, PRECISE 1-3 had a four-year PFS of 81%, while PRECISE 4-5 had a PFS of 43% ($p < 0.001$). (Figure 1)

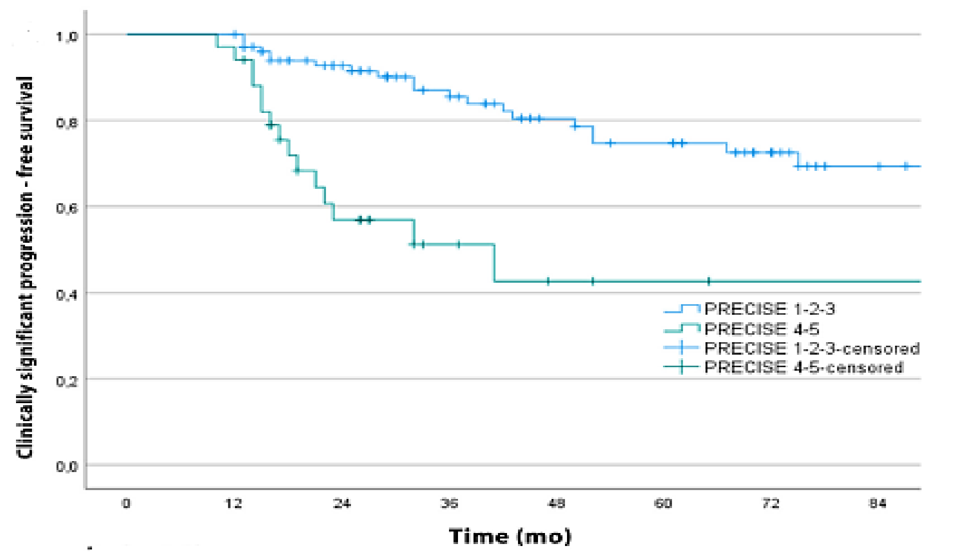

Figure 1: Kaplan-Meier curves depicting the rate of clinically significant progression within 18 months of diagnosis.

Discussion: The PRECISE recommendations were created to make it easier to build a solid evidence database for tracking changes in prostate MRI findings over time in men who are under active surveillance.[3] Overall, the PRECISE scoring system performed well, and its high negative predictive value may be able to reduce the number of further biopsies needed in patients taking AS.[4]

Conclusion: The current study concludes that adopting PRECISE grading for PCa patients on AS is possible and has prognostic utility. Patients who have a confirmation MRI with a PRECISE score of 4-5 within 18 months of their diagnosis are three times more likely to experience clinically significant progression after 4 years.

The Prostate Cancer Radiological Estimation of Change in Sequential Evaluation (PRECISE) grading is efficient and helps in identifying prostate cancer patients who require additional treatment.

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3. Compare the outcomes between diabetic and Nondiabetic Kidney Transplant Patients: Survival analysis of a retrospective cohort

Introduction: Diabetes mellitus (DM) and hypertension are the leading causes of advanced chronic kidney disease (CKD), accounting for nearly 80% of cases.[1] One of the most prevalent causes of end-stage renal disease in the world is type 2 diabetes. In Australia, the prevalence of type 2 diabetes among incident cases of treated end-stage kidney disease (ESKD) increased from 35% in 2001 to 47% in 2013. Patients on the dialysis waiting list and kidney transplant recipients also had similar increases. Although transplantation is the preferred course of treatment for the majority of patients with end-stage renal disease (ESRD), inadequate access to transplantation for people with diabetes who have ESKD appears to be a global issue.[2] In terms of extended survival times, improved quality of life, and cost savings over dialysis, kidney transplantation (KT) is the best renal replacement therapy. However, ESRD patients have significant co-morbidities and are elderly, which can be linked to significant mortality rates, such as those linked to cancer and primarily cardiovascular causes, which are higher than in the general population and account for roughly one-third of known cause deaths in transplant patients.[1]So, this study aims to evaluate the outcomes of patients with end-stage kidney disease caused by diabetes (ESKD-DM) and ESKD caused by non-diabetic aetiology (ESKD-non-DM) who underwent kidney transplantation (KT) during a 10-year period.

Methods: A total of 375 patients over the age of 18 who had pre-emptive living and deceased donor KT were included in this retrospective cohort study. Due to the potential for primary graft failure from surgical, vascular, or immunologic factors that might affect renal graft survival, patients with combined pancreas and KT and less than 3 months of follow-up were excluded. The data was collected from both recipients and donors. Recipient's age, BMI, sex, cause of chronic kidney disease, type of dialysis, waiting list entry date, date of dialysis initiation, comorbidities, serostatus for hepatitis and cytomegalovirus (CMV), donor's age, type (deceased or living) and transplant data such as date, number of transplants, ischemia time, HLA mismatch, induction therapy, and BK polyomavirus infection. The clinical nephrologist diagnosed the patient with diabetes-related ESKD and then forwarded him or her to the transplant team. The medical records were used to identify the kidney disease's aetiology. The majority of individuals did not undergo a kidney biopsy. Acute kidney impairment following transplantation resulting in a week of dialysis was referred to as delayed graft function. Except for those at high risk who got treatment for 180 days, all patients received valganciclovir for 90 days as CMV prophylaxis. Blood or tissue PCR was used to confirm the diagnosis of CMV infection. After performing a biopsy, cellular rejection was identified using the Banff criteria.

Results: Patients with ESKD-DM had decreased overall survival rates at 5 (75.0%) and 10 (55.0%) years. Patients with diabetes had a greater rate of cardiovascular death. In both groups, death-censored graft survival was similar. According to multivariate analysis, diabetes, recipient age, delayed graft function, and donor age are the factors linked with global survival. Only the cardiovascular death group showed an association between DM and mortality in the competing risk analysis (sub-hazard ratio [SHR] = 6.06, 95% CI = 1.01-36.4, P =0.049). (Table 1)

Covariate	Cardiovascular death SHR	Cardiovascular death 95% CI	Cardiovascular death P value	COVID death SHR	COVID death 95% CI	COVID death P value	Overall death[a] SHR	Overall death[a] 95% CI	Overall death[a] P value
DM	6.06	1.01-36.4	.049	1.57	0.59-4.16	.355	1.66	0.83-3.33	.146
Recipient age	1.09	1.01-1.18	.033	1.07	1.03-1.11	<.001	1.03	1.00-1.06	.050
DGF	2.09	0.43-10.1	.358	3.33	1.27-8.70	.014	1.34	0.69-2.63	.381
Donor age	1.10	1.04-1.16	<.001	0.97	0.94-1.01	.210	1.04	1.01-1.07	.002

[a]Overall death: Death for causes different to cardiovascular death and COVID death; SHR = sub-hazard ratio; CI = confidence interval; DM = diabetes mellitus; DGF = delayed graft function.

Table 1: Competing Risk Regression Analysis Based on Subdistribution Hazard Models for Cardiac Death, COVID Death, and Overall Death in Patients with Kidney Transplantation

Discussion: The competing risks analysis in this investigation revealed that ESKD-DM was exclusively related to the worst survival functions in the cardiovascular death category, where it accounted for 27.27% of all causes of death in patients with diabetes compared to 8% in individuals without diabetes. Both diabetic (30.3%) and nondiabetic (32.6%) patients' deaths were most frequently caused by infection, most likely as a result of the increased mortality caused by COVID during the pandemic.[1] A study compared patients with and without kidney disease to patients undergoing hemodialysis and receiving renal transplants to examine the mortality of COVID-19 infection in CKD. Adjusted mortality was significantly greater in the heart disease and CKD groups, but it was not significantly different in the renal transplant group.[3] Similar findings were seen in another multicentre controlled study, with older COVID-19 patients with stage 3 to 5 CKD on continuous hemodialysis dying at a much higher rate than older patients without CKD.[4]

Conclusion: The current study concludes that patients with and without diabetes mellitus had comparable death-censored kidney graft survival rates.. Patients with diabetes have decreased overall survival rates, which may be related to advanced age, increased BMI and cardiovascular comorbidities.

Patients with diabetes may find it easier to get onto the kidney transplant waiting list if their concomitant conditions, such as hypertension, dyslipidemia, and coronary artery disease, are managed.

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4. Severe asymptomatic bilateral ureteropelvic junction obstruction: A case report

Introduction: Antenatal and neonatal hydronephrosis are most frequently caused by uretero-pelvic junction (UPJ) obstruction. The prevalence is predicted to be one per 1500 live births, with a male-to-female ratio of 3–1. Prenatal ultrasonography screening is frequently used to make the diagnosis, although in cases where prenatal care is not received, symptoms like discomfort, haematuria, urosepsis, failure to thrive, or a palpable abdominal mass may appear.[1] Some patients won't exhibit functional obstruction until later in life, despite the fact that a considerable portion of these instances will ultimately need surgical intervention. The anatomical origin and degree of UPJ blockage, renal pelvic compliance, and urine flow rate and output all influence renal function stability.[2] In this case, an elderly man was discovered to have asymptomatic, severe bilateral UPJ blockage with normal renal function.

Case presentation:

A 68-year-old male patient was admitted to the hospital and underwent routine analysis to investigate chronic orthostatic hypotension, but eventually asymptomatic microscopic haematuria was present. The patient had a stable serum creatinine level with normal renal function and no proteinuria. A CT scan of the abdomen/pelvis without and with IV contrast, as well as CT urography, revealed significant bilateral ureteropelvic junction (UPJ) constriction, severe bilateral hydronephrosis, and several non-obstructing stones in the right kidney. (Figure 1) There were no aberrant crossing vessels identified. Additionally, the terminal ileum displayed accidental segmental thickening, which was later identified as Crohn's disease. Continuous radiotracer clearance was seen during the furosemide washout MAG3-Tc^{99} scan from both kidneys, but more slowly from the right kidney than the left. Peak times on the renogram are 18 (left) and 27 (right) minutes, whereas half-peak times are 47 (left) and 60 (right) minutes. Half-peak times on a furosemide renogram are 11 (on the left) and 10 minutes, respectively. The patient was treated conservatively with regular monitoring of kidney function. For the last 7 years, patients have had stable kidney function without any worsening of kidney damage.

Figure 1: The coronal view of the contrast-enhanced CT scans nephrogram phase reveals bilateral dilatation of renal pelvises (*), more severe on the right side, and a non-obstructing stone in the right renal pelvic (arrow).

Discussion: Congenital UPJ blockage is more prevalent in men and more frequently on the left side, occurring in 1 in 500 live births.[2] The most typical form of presentation is hydronephrosis. Other frequent clinical manifestations include hematuria, fever, nausea/vomiting, pyelonephritis, abdominal mass, ureteric stone, loin discomfort, and etc.[3] In this case, a routine urinalysis revealed asymptomatic microscopic hematuria in a patient who presented with chronic orthostatic hypotension. A CT scan of the abdomen/pelvis without and with IV contrast, as well as CT urography (Figure 1), revealed significant bilateral ureteropelvic junction (UPJ) constriction, severe bilateral hydronephrosis, and several non-obstructing stones in the right kidney.[2]

Conclusion: Ureteric-pelvic junction obstruction was managed by conventional treatment; if intermittent or persistent loin discomfort, acute pyelonephritis, decreasing renal function, and gradual thinning of the renal cortex are present, surgery is indicated. The Onen grading system is an additional technique for identifying the need for surgery.

Prenatal ultrasonography was performed to detect uretero-pelvic junction obstruction

References:

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